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EVIDENCE FOR MULTIVOLTINISM IN *PRODIPLOSIS PLATANI* GAGNÉ (DIPTERA: CECIDOMYIIDAE), A LEAF CURL MIDGE OF AMERICAN SYCAMORE

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Abstract.—Seasonally observed pulses of leaf curls caused by larval feeding suggest a sycamore leaf curl midge, *Prodiplosis platani* Gagné is multivoltine with five to six generations per year. Larvae feed on the abaxial lateral surface of new or expanding leaves and cause the margins to curl tightly, disfiguring the leaf. Frequency of larval activity was measured by periodically counting new leaf curls. In 1983 and 1984, from early June to early October in Maryland, five to six peaks occurred at 16–17 day intervals. Larvae are actively sought as food by adults of many species of coccinellids and the curls serve as retreats for spiders. Pteromalid and eulophid parasites were recovered from the pupae.

Key Words: Sycamore, *Prodipolis platani*, generations, parasites

The recently described leaf curl midge *Prodiplosis platani* Gagné, (Gagné 1986) is a potential pest of American sycamore saplings (*Platanus occidentalis* L.) in eastern North American nurseries. Larvae feed on the surface of abaxial lateral margins of young leaves. These become disfigured as feeding causes the leaf margins to curl tightly during growth. The literature of the nine known species of *Prodiplosis* in N. America includes reports on the biology of *P. citrulli* (Felt) (Wehrle 1946), *P. morrisi* Gagné (Morris 1981), *P. vaccinii* (Felt) (Driggers 1926) and *P. violicola* (Coquillett) (Garman 1922). Each of these reported species has been described as a pest causing economic damage. There are no previous reports on the biology of *P. platani*. Gagné (1986) noted that *P. platani* was first collected in New York [= *Cecidomyia* sp., Felt (1940)] and later from New Jersey, Pennsylvania, and Maryland. Larval feeding damage by *P. platani* was first observed on young American sycamores in research plots at the United States Department of Agriculture, Agricultural Research Center, Beltsville, Maryland throughout the summer of 1982 and has since been observed on sycamores in Prince George's and Howard counties, Maryland. The observed chronic appearance of leaf curls during the growing season prompted our study to determine the frequency of occurrence that would provide data on seasonal activity that could be quantified. Limited observations on the cocoon and predators and parasites are provided.

MATERIALS AND METHODS

In this study six sycamores at the Agricultural Research Center that had been propagated four years earlier by rooted cuttings from a single sycamore were used. The trees had been spring-pruned in the early growth stage to promote sprouting and each plant consisted of several long shoots not exceeding 10 feet in height. Sycamores have

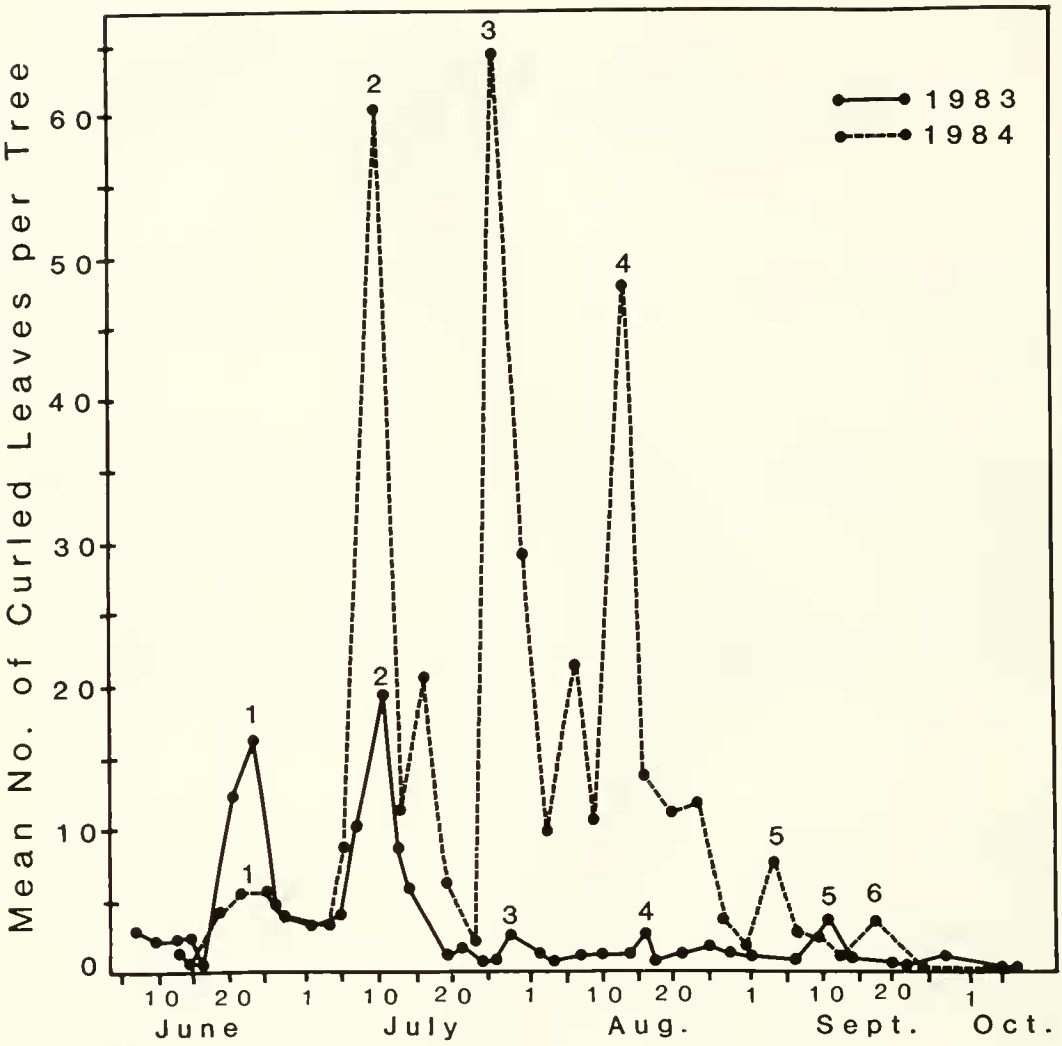

Fig. 1. Mean number of new leaf curls per American sycamore tree in 1983 and 1984. Coincident numbers under peaks represent larval pulses.

indeterminant growth (oaks, *Quercus* have determinate growth and produce two flushes of annual growth) during the growing season and will continue to produce new terminal growth and new leaves as a result of available water. During the first year of study (1983) the sycamores were watered on July 7 and August 22. A repeat study was conducted in 1984 because the first year data suggested several generations. During 1984 trees were watered frequently to promote terminal growth and thus increase the number of new leaves and the potential rate of infestation. The relatively large number of new growth leaves would amplify the larval activity pulses that would occur. The six plants were observed three times a week in 1983 and twice a week in 1984. All leaves on each plant were examined independently by two observers. Each leaf with surface

wrinkling or an incipient curl was marked on the adaxial surface to indicate that it had been observed and recorded.

Results and Discussion

Continuous new leaf production by the sycamores was obtained during the 1984 growing season as a result of frequent watering. The higher number of new leaves resulted in a corresponding higher incidence of infected leaves than in 1983. The mean number of observed new curled leaves by tree per date is presented in Fig. 1. In 1983 a total of 737 curled leaves ($\bar{x}$ = 122.8/tree) was counted and in 1984 2216 ($\bar{x}$ = 369.3/tree) were counted. In 1983 there were five pulses of larval activity. Pulses one and two at 16 and 17 days apart were recorded on the relatively young growth during June and July, three subsequent minor increases of leaf curls with similar temporal spacing followed. In 1984 six pulses of larval activity were observed with peaks 1, 2 and 3 coincident with the first three peaks of 1983. The first pulse, a result of spring-emerged adults, was minor. Activity pulses 2, 3 and 4 were each followed by minor emergences and may result from the sampling intervals. Pulses 5 and 6 in September were minor which may have resulted due to the normal seasonal decline in tree growth. Larval activity for both years commenced in early to mid June and ended in early October. These findings are similar to those seasonal studies of *P. morrisi*, found from June to August on poplar (*Populus deltoides* Bartram) and hybrid poplars (Morris 1981); Morris (1981) reported five generations with an average development period per generation of 16 days based on adult emergences. Larval pulses by *P. platani* suggest a corresponding development time. Our observations suggest that the unsightly feeding damage is accumulative and results in a general ambiguity of the existing 5 to 6 generations without frequent sampling. Because several generations occur on a season's foliage and the damaged leaves do not drop, the cumulative damage can be aesthetically detrimental.

Midge larvae construct white, double convex silken cocoons in the leaf curl. These are formed near the leaf surface or among clots of stellate hairs that form as a result of larval feeding and movement on the surface. Many species of adult coccinellids were observed searching for larvae and pupae in the curl. The curls also provide retreat for hunting spiders such as Salticids. Parasites included Pteromalidae (*Zatropis* sp.) and Eulophidae (*Tetrastichus* sp.) that emerged in the laboratory from pupae collected June 15, 1983. Data from this study indicate that *P. platani* is multivoltine and have established it as a potential pest on rapid growing sycamores.

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